

FEASIBILITY ANALYSIS OF GROUND SUPPORT EQUIPMENT (GSE) ON GROUND HANDLING SERVICES AT HANG NADIM INTERNATIONAL AIRPORT BATAM

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ABSTRACT

The purpose of the research is to determine the fulfilment of Ground Support Equipment (GSE) feasibility standards and the potential impacts that will arise from its operation. Then formulate steps to ensure Ground Support Equipment (GSE) meets the feasibility standards in KP 635 Year 2015. The method used is descriptive qualitative with data collection techniques of observation, interviews and document studies. The results of the study found that the Ground Support Equipment (GSE) operated has not met all the feasibility standards in KP 635 of 2015. Potential impacts that will arise if Ground Support Equipment (GSE) continues to be operated, including hampering ground handling activities, ground time standards are not met, causing work accidents, and other negative impacts.

Keywords: *feasibility standards, Ground Support Equipment (GSE), ground handling*

1. INTRODUCTION

Hang Nadim International Airport Batam is an airport managed by PT Bandara Internasional Batam (PT BIB) located in the Riau Islands [1]. Airlines operating at the airport include Garuda Indonesia, Citilink, Lion Air, Super Air Jet, Batik Air, Wings Air, Nam Air and Susi Air as well as Malindo Air international flights. Airlines have the responsibility to provide maximum service to passengers in the three phases of flight including pre-flight service, in-flight service and post-flight service [2]. In the pre-flight and post-flight phases, ground handling is very influential to create flight safety, on time performance, customer satisfaction and reliability [3].

The equipment used in ground services is Ground Support Equipment (GSE) which is a certain vehicle and machine tool that functions as a service support equipment operated by experts [4]. Stakeholders that provide ground handling services at Hang Nadim Airport Batam include PT Gemalindo Air Support (GAS) handling Lion Air airline aircraft and PT Gapura Angkasa Citilink Indonesia airline aircraft. Ground Support Equipment (GSE) that is operated must meet the aspects of the airworthiness standards contained in the Regulation of the Director General of Civil Aviation Number KP 635 of 2015 concerning Standards for Ground (GSE) and Operational Vehicles Operating on the Airside. However,

based on the findings in the field there are still many Grounds Support Equipment (GSE) operated that do not meet the existing feasibility aspects. From the above findings, this research was conducted with the aim of knowing the fulfillment of the feasibility of Ground Support Equipment (GSE) in operation, the potential impact that will arise from the operation of Ground Support Equipment (GSE) that has not met the feasibility standards and is expected to formulate steps that can be used in an effort to ensure the fulfillment of feasibility standards.[5].

2. LITERATURE REVIEW

Referring to the regulations contained in KP 635 Year 2015, Ground Support Equipment (GSE) or also called aircraft ground service support equipment is auxiliary equipment prepared for handling aircraft and passengers on the ground at the time of arrival and / or departure, loading and / or unloading passengers, cargo and postal [4]. Ground handling is defined as the knowledge and skills in the process of handling aircraft on the apron, handling passengers and their luggage in the terminal and cargo, and post in the cargo area [6].

Based on KP 635 Year 2015 Ground Support Equipment (GSE) Feasibility Standards as follows:

Table 1. Ground Support Equipment (GSE) Feasibility Standards Based on KP 635 Year 2015

No.	Aspects	Terms	
		Motorized	Non-Motorized
1	Machine	Using maximum Euro 3 standard diesel type or electric drive	-
2	Design	Ease of operation 1 (one) person	Ease of operation 1 (one) person
		Ease of mobilization and demobilization	Ease of mobilization and demobilization
		In accordance with the aircraft handled	
3	Materials	Qualified and must be maintained in factory-standard specific condition	Qualified and must be maintained in factory-standard specific condition
		Resistant to rust	Resistant to rust
		Frame and body painted and coated with anti-rust protection	Frame and body painted and coated with anti-rust protection
4	Body	The exterior and interior are firmly and neatly attached and have no sharp corners.	Able to withstand loads above 15% above the planned load.
		Equipped with operator logo on 2 sides with maximum size of 30 x 30	Body corners should not be sharp and impact protection rubber is installed.
5	Color	Painted with light color and installed	Painted with light color and installed

		spotlight on each side	spotlight on each side
6	Name Plate	Contains information including serial number, brand, model type, equipment manufacturer, year of manufacture, power and capacity.	Contains information including serial number, brand, model type, equipment manufacturer, year of manufacture, power and capacity.
7	Safety Devices	There is an emergency stop button, parking brake, lightweight fire extinguisher and obstacle light.	Equipped with parking brake or wheel chocks
8	Equipment Age [7]	Age limit 15 and 10 years	Age limit 15 and 10 years
9	Operation	Air-side operated	Air-side operated
10	Environment	There must be no lubricant (oil) leaks	-
11	Indicator Panel	Charging system available	-
		Engine oil pressure gauge	
		Hydraulic oil pressure gauge	
		Engine coolant temperature gauge	
		Speed meter (speedometer)	
Engine RPM instructions			
Hour meter and Fuel Meter			
12	Electrical System	Power cables are laid in harnesses, explosion proof and watertight	-
		Equipped with night lighting,	-

		turn signals (flashing yellow), brake lights (red on) and a bell (horn).	
13	Tow Hitch	Cart/trailer models with tow hitch GSE with tow bar must be collapsible	-
14	Cabin	Enclosed cabled units equipped with windshield washers	-

3. METHODS

2.1 Research Design

The research method used is descriptive qualitative is a data analysis method to reveal, understand and interpret a phenomenon that occurs in the research subject by describing data and facts in the form of words and language as a whole [8].

2.2 Research Setting

The research location is the airside of Hang Nadim Airport Batam. The location was chosen to be used as a research site because problems were found in the Batam Hang Nadim Airport apron which included the air side. The research time began when carrying out On the Job Training at Hang Nadim International Airport Batam for approximately 3 months from December 2023 to February 2024.

2.3 Source Research

The research data sources consist of research subjects and objects. The research subjects were 3 ground handling personnel of PT Gemalindo Air Support (GAS) and 3 personnel of PT Gapura Angkasa as informants. The objects observed were Ground Support Equipment (GSE) operated by PT Gemalindo Air Support (GAS) on Lion Air flights with flight number JT972 route KNO- BTH-SUB and PT Gapura Angkasa during ground handling services on Citilink Indonesia flights with flight numbers QG942-QG943 route CGK-BTH-CGK.

2.4 Collective data technic

Data collection techniques are methods used to collect data in research, where the methods used require rare - strategic and systematic steps so that the data obtained is valid. [9]. The data collection techniques used consist of observation, interviews and literature studies.

2.4.1 Observation

The observation technique used is passive participant observation where the researcher makes direct observations in the field but does not participate in ongoing activities [10]. The research instrument used is a checklist for checking the feasibility of GSE based on KP 635 2015.

Nama Perusahaan :				
Hari/Tgl Pemeriksaan :				
Nopol/Nolam :				
Jenis GSE :				
No	Jenis Pengecekan	Kondisi		Keterangan
		Baik	Rusak	
1	Mesin			
2	Kesesuaian Desain			
3	Cat Kendaraan terang			
4	Terdapat <i>scotlight</i>			
5	Bahan anti karat			
6	Kondisi ban			
7	Exterior dan interior terpasang rapih			
8	Sudut tidak tajam			
9	Logo perusahaan			
Name Plate				
10	Fabrikasi pembuat peralatan			
	Tipe/model			
	Nomor seri			
	Tahun fabrikasi			
	Daya kapasitas			
Safety devices				
11	Emergency stop			
	Parking brake			
	Obstacle light			
	Rem pedal			
12	Kaca spion kiri dan kanan			
13	Usia peralatan			
14	Pengoperasian			
15	Kebocoran Oli			
Panel Indikator				
Charging system				
16	Pengukur tekanan oli mesin dan oli hidrolik			
	Pengukur temperatur pendingin mesin			
	speedometer			
	Petunjuk RPM mesin			
	Hour meter dan fuel meter			
17	Sistem Kelistrikan			
Kelengkapan Kelistrikan				
17	Lampu penerang			
	Lampu sein			
	Lampu rem			
	Bel (horn)			
18	Tow Hitch (model <i>chart/trailer</i>)			
19	Windshield washer (unit berkabin)			

Figure 1. Observation Checklist

2.4.2 Interview

Using structured interviews by preparing interview guidelines in the form of research instruments [11]. The interview research instrument is in the form of written questions related to GSE airworthiness standards based on KP 635 2015. Where each informant is given the same question and the researcher records each answer from the informant. Then the answers were validated using the source triangulation technique [12].

2.4.3 Literature Documents

Document study is a data collection technique used to obtain data that can provide information on the object of research, especially documents related to the focus of

the problem under study, both documents in the form of important records, laws and regulations, manuscripts, photographs, manuscripts, and other documents that can support the research [11].

The documents used in the document study are data on the block on and block off times of Lion Air aircraft with flight number JT972-JT972 route KNO-BTH-SUB and on Citilink Indonesia aircraft with flight number QG942-QG943 route CGK-BTH-CGK, to determine the length of the ground handling process by PT Gemalindo Air Support and PT Gapura Angkasa [13].

2.5 Data analysis techniques

Data analysis is the process of systematically searching and compiling data obtained from interviews, field notes, and documentation, by organizing data into categories, breaking it down into units, synthesizing, compiling into patterns, choosing which ones are important and which ones will be studied, and making conclusions so that they are easily understood by oneself and others [12].

The data analysis technique applied in the research is the Miles and Huberman analysis technique, namely by applying 4 stages in data analysis during the field including data collection, data reduction, data display and conclusion drawing/verification [9].

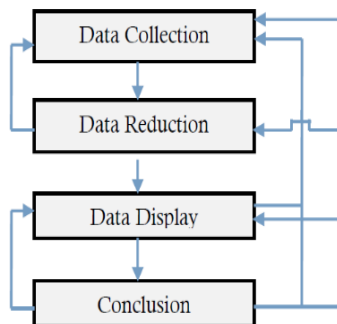


Figure 2. Qualitative Data Analysis Technique

4. RESULT AND DISCUSSION

In this research, the data to be processed is obtained from the application of 3 data collection techniques, namely observation, interviews and document studies.

3.1 Observation

Based on field observations that have been carried out in the ground handling process of PT Gemalindo Air Support and PT Gapura Angkasa, there are 8 types of Ground Support Equipment (GSE) that are commonly used including Aircraft Towing Tractor (ATT), Baggage Towing Tractor (BTT), Conveyor Belt Loader (CBL), Air Conditioning Unit (ACU), Ground Power Unit (GPU), Aircraft Towing Bar (ATB), Baggage Cart

(BCT), Pallet Dollies (PDL). Observations were made to 16 Ground Support Equipment (GSE) units so that a recapitulation of the observation checklist results was obtained.

No	Drive type GSE type/ Feasibility Aspects	Motorized					Non-motorized							
		ATT	BTT	CBL	ACU	GPU	ATB	BCT	PDL					
1	Machine	√	√	X	√	√	√	√	√	√	√	√	√	√
2	Design	X	√	√	√	√	√	√	√	√	√	√	√	√
3	Materials	X	√	√	√	√	√	X	X	X	X	X	√	√
4	Body	√	√	√	X	√	X	√	√	√	√	√	X	√
5	Color	√	√	√	√	√	√	√	√	√	√	√	√	√
6	Name Plate	X	√	X	X	√	√	√	X	√	√	√	X	X
7	Safety Devices	√	√	X	√	√	√	√	√	√	√	√	X	X
8	Equipment Age	√	√	√	√	√	√	√	√	√	√	√	√	√
9	Operation	√	√	√	√	√	√	√	√	√	√	√	√	√
10	Environment	√	√	√	X	√	√	√	√	√	√	√	√	√
11	Indicator Panel	√	√	√	√	√	√	√	√	√	√	√	√	√
12	Electrical System	√	√	√	√	√	√	√	√	√	√	√	√	√
13	Tow Hitch	X	√	√	√	√	√	√	√	√	√	√	√	√
14	Cabin	X	X	X	X	X	X	X	X	X	X	X	X	X

Figure 3. Recapitulation of Ground Support Equipment (GSE) Inspection Checklist Results Operated by PT Gapura Air Support and PT Gapura Angkasa

Notes:

- Blue Table : PT Gapura Air Superior GSE
- Green Table : GSE PT Gapura Angkasa
- Red Table : Aspects of habitability that do not have to be met

Recapitulation of Ground Support Equipment (GSE) Inspection Checklist Results is used to obtain a percentage of fulfillment of airworthiness standards on each Ground Support Equipment (GSE) unit observed.

The formula calculates the percentage on 1 aspect:

$$\text{Percentage value of 1 aspect} = 100\% \div \text{Aspects of feasibility that}$$

Then to find out the percentage of fulfillment of the feasibility standards by means of:

$$\text{Percentage of Compliance with Fitness Standards} = \text{Percentage value of 1 aspect} \times \text{Aspects fulfilled}$$

Table 2. Calculation of Percentage of Fulfillment of Feasibility Standards

No	GSE Type	Percentage Value 1 aspect	Percentage of Compliance with Fitness Standards	
			PT Gemalindo Air Support	PT Gapura Angkasa
1	Motorized: Aircraft Towing Tractor (ATT)	$100\% \div 14 = 7,14\%$	$7,14\% \times 9 = 64,26\%$	$13 \times 7,14\% = 92,82\%$
2	Motorized: Baggage Towing Tractor (BTT)	$100\% \div 13 = 7,69\%$	$7,69\% \times 11 = 84,59\%$	$9 \times 7,69\% = 69,21\%$
3	Motorized: Conveyor Belt Loader (CBL)	$100\% \div 12 = 8,34\%$	$12 \times 8,34\% = 100,04\%$	$11 \times 8,34\% = 91,74\%$
4	Motorized: Aircraft Conveyor Unit (ACU)	$100\% \div 12 = 8,34\%$	$12 \times 8,34\% = 100,04\%$	$12 \times 8,34\% = 100,04\%$
5	Motorized: Ground Power Unit (GPU)	$100\% \div 12 = 8,34\%$	$10 \times 8,34\% = 83,4\%$	$10 \times 8,34\% = 100,04\%$
6	Non-motorized: Aircraft Towing Bar (ATB)	$100\% \div 8 = 12,5\%$	$7 \times 12,5\% = 87,5\%$	$7 \times 12,5\% = 87,5\%$
7	Non-motorized: Baggage Cart (BCT)	$100\% \div 8 = 12,5\%$	$4 \times 12,5\% = 50\%$	$5 \times 12,5\% = 62,5\%$
8	Non-motorized: Pallet Dollies (PDL)	$100\% \div 8 = 12,5\%$	$6 \times 12,5\% = 75\%$	$7 \times 12,5\% = 87,5\%$

From the results of the research conducted, it was still found that the Ground Support Equipment (GSE) operated did not meet all the feasibility standards contained in KP 635 Year 2015. Of the 16 units observed, only 4 units of Ground Support Equipment (GSE) meet all standards of possibility with a percentage of 100% while 12 of them still do not meet with a percentage below 100%. The four Ground Support Equipment units that meet all airworthiness standards are Conveyor Belt Loader (CBL) and Aircraft Conveyor Unit (ACU) operated by PT Gemalindo Air Support and Ground Power Unit (GPU) and Aircraft Conveyor Unit (ACU) operated by PT Gapura Angkasa.

The following is documentation of observations and findings of unmet aspects of Ground Support Equipment (GSE) operated by PT Gemalindo Air Support and PT Gapura Angkasa, based on the results of the Ground Support Equipment (GSE) inspection checklist.

**Figure 4.** Baggage Towing Tractor operated by PT Gapura Angkasa.

In the picture above, Ground Support Equipment (GSE) is found that does not meet the environmental aspects because it has an oil leak on the GSE which is a hazard on the apron.

**Figure 5.** Baggage Cart operated by PT Gemalindo Air Support.

In the picture above, Ground Support Equipment (GSE) is found that does not meet the body aspects,

namely there is no protection at the sharp corners of the GSE which can be dangerous when operated.

3.2 Interview

Based on the results of direct interviews conducted with 6 informants from PT Gemalindo Air Support and PT Gapura Angkasa personnel. Conclusions were obtained regarding the fulfillment of the Ground Support Equipment (GSE) feasibility aspects and the impact that will arise from the operation of Ground Support Equipment (GSE) that has not met the feasibility standard aspects.

Where 14 aspects of the Ground Support Equipment (GSE) feasibility standards contained in KP 635 2015 must be fulfilled all to avoid potential negative impacts that will arise in operations during ground handling activities. [14]. The potential impacts that will arise if Ground Support Equipment (GSE) that does not meet the feasibility standards continues to be operated include:

- a. Inhibits ground handling activities so that the services provided are not optimal;
- b. Unable to meet the company's ground time standards and on time performance aspects;
- c. Risk of causing accidents between GSE and GSE, GSE and aircraft and GSE and operators;
- d. Threatens the work safety of the crew handling the ground handling process in the apron area;
- e. May damage the fuselage and critical components of the aircraft;
- f. It can damage both the GSE's external and internal components. Such as porous or loose GSE body at any time, damaged GSE engine and other components;
- g. Risk of damaging goods or cargo carried by GSE;
- h. Causes difficulties in movement and operation of the GSE especially at night when visibility is low;
- i. Potential as a hazard that can cause accidents and incidents;
- j. The company can be penalized if a check is made of the GSE's fitness and the GSE is found not to meet the standards;
- k. There is a risk of speed violations by GSE operators if the speed indicator is damaged.

3.3 Document Study

The supporting documents used are block on and block off time data of Lion Air aircraft with flight number JT972-JT972 route KNO-BTH-SUB handled by PT Gemalindo Air Support and on Citilink Indonesia aircraft with flight number QG942-QG943 route CGK-BTH-CG handled by PT Gapura Angkasa. The data to be analyzed is data obtained in December 2023 - February 2024 at Hang Nadim Airport Batam. From the ground time data,

the average ground handling service time for each flight is sought. [15].

Table 3. Average Ground Time

Time span	Average ground time	
	JT972	QG942-QG943
Week 1	55,34	41,09
Week 2	47,26	40,26
Week 3	54,09	38,26
Week 4	62,43	37,26
Week 5	44,26	43,43
Week 6	46,17	46,09
Week 7	41,43	38,34
Week 8	51,26	40,26
Week 9	47,26	42,00
Week 10	53,34	43,34
Week 11	46,51	36,43
Week 12	50,15	38,15
Average ground time within 3 months	50.09 minutes	40.34 minutes

There was a difference of 5 minutes in the average ground handling service for Lion Air JT 972-JT 972 aircraft by PT Gemalindo Air Support for 3 months. Where in the Lion Air airline Standard Operating Procedure is 45 minutes. As for Citilink Indonesia's aircraft with flight number QG942-QG943 handled by PT Gapura Angkasa, the ground handling time is in accordance with Citilink Indonesia's Standard Operational Procedure of 40 minutes and the average ground handling for 3 months is found to be appropriate. But it can still be found on average in some weeks both the handling of PT Gemalindo Air Support and PT Gapura Angkasa is still not in accordance with the Standard Operating Procedures of each airline.

5. CONCLUSION

1. It is still found that Ground Support Equipment (GSE) operated in ground handling services by PT Gemalindo Air Support and PT Gapura Angkasa at Hang Nadim International Airport Batam has not met all the standards based on KP 635 Year 2015.
2. It was found that there are potential impacts that will result from the operation of Ground Support

Equipment (GSE) that does not meet existing standards of feasibility. The impact that will arise can hamper the aircraft ground handling process and potentially threaten work safety.

3. Steps that can be taken in ensuring that the Ground Support Equipment (GSE) operated meets the eligibility standards, including routine checks and maintenance by the ground handling company by assigning Ground Support Equipment (GSE) operators. There is also a need for routine inspection and random check of Ground Support Equipment (GSE) units by Apron Movement Control (AMC). [16].

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